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ABSTRACT

A study sought to determine the stability of student/teacher interactional gymnasium behavior over one academic year. The design of the study was a single-subject, time-series analysis. The subject was a male elementary school physical education teacher with 14 years of experience. Data were collected using the Cheffers Adaptation of Flanders Interaction Analysis System (CAFIAS) with observations made at equally spaced intervals throughout one school year. A total of 52 useable observations were obtained and analyzed to determine behavioral stability. Only one-quarter of the CAFIAS behavior categories were found stable and these behaviors accounted for less than 30 percent of all behavior. This led to the conclusion that teaching behavior in this physical education setting may lack the stability necessary for making inferential generalizations common to the natural science paradigm used in research into teacher behavior. It is concluded that teaching may be a social rather than a natural phenomenon. The results of both this study and previous research found that teaching behavior fluctuates in unpredictable patterns, and additional research paradigms, along with natural science methodologies, may depict a more accurate and complete picture of teaching in the gym. The study suggested a need for more long-term investigations of teaching. (JD)

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Stability in the Gym:

A One-Year Time-Series Analysis

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Behavioral stability is a basic tenet of the natural science paradigm when applied to physical education teaching research. The assumption and/or determination of stability allows for two key components of the research process. First, behavioral stability allows the researcher to attribute detected behavior changes to the experimental treatment. Secondly, behavioral stability allows for the assumption that detected change is relatively permanent and predictable, thus permitting generalizations from findings.

The natural science model appears to serve as the dominate model for researching teaching in physical edcuation. This paradigm has been regarded as a productive, reliable and pragmatic avenue for extending scholarly understanding of the phenomenon of teaching in the gym (Locke, 1977; Siedentop, 1982). The acceptance of this posture has led to a rapid and systematic growth in empirically-derived conclusions relative to movement pedagogy (Anderson & Barrette, 1978; Siedentop, 1981; Dodds, Rife & Metzler, 1982). It therefore seems much of what we have concluded about teaching physical education is based on the assumption that the teaching we are talking about is stable.

Several researchers have seemingly recognized the possible limitations of assuming behavioral stability by attempting to either control or account for teaching variability (McKenzie, 1981; Rink, 1983; Lombardo & Cheffers, 1983). These studies acknowledge the generalizability and inferential limitations of research which fails to determine the stablity of the

behavior under investigation. The results of these initial stability studies are mixed. Some behaviors seem stable (McKenzie, 1981; Rink, 1983; Lombardo & Cheffers, 1983) and other behaviors appear to fluctuate (Rink, 1983, Lombardo & Cheffers, 1983). However, too few studies have been completed to determine conclusive consistency from research results.

Two obvious characteristics in the literature on teaching stability in physical education are 1. there seems to be very little of it (Rink, 1983; Lombardo & Cheffers, 1983) and 2. teaching behavior stability has been determined over relatively short time periods: McKenzie observed behavior for 5 days before declaring it stable, Rink studied behavior for 14 days, and Lombardo & Cheffers made observations for 20 consecutive days. When one considers the average school year lasts 180 days and the average teaching career lasts somewhat longer, these time-frames appear somewhat restricted. If determining the stability of teaching behavior is, as Rink (1983) suggested, a critical issue in teaching effectiveness research, there appears a very definite need for additional research with expanded time-frames. Therefore, the purpose of this study was to determine the stability of student/teacher interactional gymnasium behavior over one academic year.

Methods

The design of this study was a single-subject, time-series analysis. The subject was a male elementary physical education teacher. This teacher possessed 14 years teaching experience and taught physical education for grades K-6 in a single school. Data were collected over one academic year

(September-May) using the Cheffers Adaptation of Flanders Interaction Analysis System (CAFIAS) (Cheffers, Mancini, & Martinek, 1980). Observations were made at equally spaced intervals throughout the year. No more than one observation was made per day and no more than 5 school days lapsed between observations. A total of 52 useable observations were obtained.

Reliability of the data was determined using both intra- and interobserver reliability estimates. Intraobserver reliability was derived by having the investigator code a videotape of the studied teacher twice. The time lag between the first coding and the second was 21 days. Interobserver reliability was established by having the principal investigator code a second videotape of the same teacher and then having a second person not affiliated with this study code the same tape. Dr. Thomas J. Martinek of the University of North Carolina was kind enough to serve as the second coder and had previously demonstrated competence as a CAFIAS coder. CAFIAS data are analyzed from a matrix, therefore the top cells of the matrices from the reliability codings were rank ordered and applied to Spearman Rank Order correlation analyses. Both the intra- ($r=0.77$) and interobserver ($r=0.78$) reliability estimates were found significant beyond the .05 level. It was therefore concluded the gathered data for this study was significantly reliable for the purposes of analysis and interpretation.

Data from the 52 observations were then analyzed to determine behavioral stability. The 20 CAFIAS category percentages were applied to univariate Box-Jenkins time-series analyses. These analyses identified those variables with significant ($p<0.01$) stationarity to be considered stable

over the academic year.

Results

Autocorrelation functions resulting from the time-series analyses indicated only 5 of the 20 CAFIAS categories demonstrated significant ($P<.01$) stationarity to generate accurate forecast models. The stable interactional behaviors were verbal teacher direction giving, verbal and nonverbal student initiated response, confusion and silence. Table 1 presents the autocorrelation functions for the significant variables.

Show Table 1 here

The relatively high autocorrelation functions in the first few lags followed by a rapid decline in the functions indicates the variable has achieved significant stationarity or stability to make it an accurate predictor or forecaster of subsequent behavior. Diagnostic chi-square statistics supported the finding of stationarity for 5 CAFIAS variables. Table 2 presents the chi-square analyses.

Show Table 2 here

Log transformation and differencing procedures were applied to those variables failing to demonstrate significant stability. The change in stationarity did not appear to be great enough to determine these 15 remaining variables as naturally stable behaviors. Adding the percentages of behavior accounted for by the significant variables revealed that 28.5%

of the total student/teacher interaction was stable over the academic year.

Discussion

Finding only one quarter of the behavior categories stable and having these behaviors account for less than 30% of all behavior, led to the conclusion that teaching behavior in this physical education setting may lack the stability necessary for making inferential generalizations common to the natural science paradigm. The need for repetition of this study should be obvious from a methodological standpoint alone. Future research in this line should employ different teaching populations using additional methods and systems of observation. Perhaps studying a greater number of teachers and behavior variables will yield different results. As with any single-subject research, replication is necessary to corroborate findings and provide definitive, generalizable conclusions.

The findings of this study also support the need for repetition. If these results are found consistent through additional endeavors they may hold serious implications for the way we research teaching physical education. Specifically, two major implications may exist. First, if teaching behavior lacks stability, only limited confidence may be appropriate for studies using a natural science paradigm. This calls for the research consumer to seek supporting evidence from several studies on a selected topic. It also calls for the researcher to both systematically replicate their work to strengthen findings and to establish the stability of the behavior they study before making generalizations. Secondly, the findings of this study suggest a need for additional paradigms to study teaching.

Perhaps teaching is not, as some (Siedentop, 1982) believe, a natural phenomenon. Natural phenomenon are governed by natural and predictable laws. The natural science paradigm is designed to uncover those laws. However, teaching may be a social rather than a natural phenomenon. Social phenomenon are governed by social laws which are susceptible to fluctuating norms, values and influences of the contextual culture. The results of both this study and previous research (Rink, 1983) found that teaching behavior fluctuates in unpredicatable patterns. These findings suggest additional research paradigms, along with natural science methodologies, may depict a more accurate and complete picture of teaching in the gym.

This study further suggested a need for more long-term investigations of teaching. The present findings are in conflict with some of the previous research which studied teaching for short periods of time (McKenzie, 1981; Lombardo & Cheffers, 1983). The descrepancies between this study and those with conflicting findings can only be settled with additional long-term research. Short-term research may be more practical and expedient, but it may also be misleading. If we are concerned with building a data-based scholarly knowledge of teaching, myopic designs may not only distort our perceptions but may also mask critical, albeit more global, variables and concepts of movement based pedagogy. Long-term investigations may provide an avenue for identifying and understanding powerful influencers of teaching behavior we currently don't even realize exist.

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Table 1

Autocorrelation Functions for Significant

CAFIAS Variables

	Autocorrelations				
Lag	1 VTDG	2 VSIR	3 VSIR	4 C	5 S
1	0.47	0.58	0.57	0.54	0.56
2	0.48	0.54	0.35	0.39	0.20
3	0.45	0.28	0.19	0.44	0.27
4	0.34	0.35	0.21	0.29	0.39
5	0.29	0.21	0.24	0.28	0.21
6	0.30	0.29	0.41	0.30	0.07
7	0.13	0.04	0.21	0.07	0.27
8	0.07	0.04	0.00	0.01	0.34
9	0.02	-0.21	-0.11	0.01	0.17
10	0.03	-0.07	-0.06	0.00	0.09
11	-0.09	-0.15	-0.12	0.01	0.18
12	0.08	-0.01	-0.04	-0.03	0.18
Mean	7.37	5.82	4.44	5.59	5.34
S.D.	3.84	4.58	7.92	8.75	6.05

CAFIAS Variables
1. (VTDG) Verbal Teacher Direction Giving
2. (VSIR) Verbal Student Initiated Response
3. (NSIR) Nonverbal Student Initiated Respone
4. (C) Confusion
5. (S) Silence

Table 2

Diagnostic Chi-Square Statistics for

Residual Time-Series Analysis

Lag	DF	Chi-Square 1 VTDG	2 VSIR	3 NSIR	4 C	5 S
6	5	54.5*	54.6*	43.7*	50.3*	35.3*
12	11	56.9*	59.6*	48.8*	50.7*	54.7*
18	17	58.0*	62.0*	51.1*	52.3*	56.7*
24	23	61.1*	68.6*	56.0*	58.7*	70.6*
25	24	64.2*	73.9*	56.6*	60.1*	72.7*

* significant beyond .01 level.

CAFIAS Variables
1. (VTDG) Verbal Teacher Direction Giving
2. (VSIR) Verbal Student Initiated Response
3. (NSIR) Nonverbal Student Initiated Response
4. (C) Confusion
5. (S) Silence